Remarks

Applicants respectfully request the Examiner to reconsider the present application in view of the foregoing amendments to the claims and the following remarks.

The Office Action is non-final. Claims 1-3 and 5-8 are currently pending. Claims 4 and 9-10 have been cancelled without prejudice. Claim 1 has been amended to further clarify and define the invention. Support for claim 1 is based on original claim 4, now cancelled, and page 17, line 33, to page 18, line 13 of the present specification.

Entry of the present Amendment is respectfully requested.

Amendment to the Abstract

The Examiner suggests amending the abstract to a single paragraph within the range of 50 to 150 words. Applicants herein enclose a substitute Abstract at the end of this paper.

Applicants respectfully request consideration and entry of the substitute Abstract.

Objection to the Specification

The Examiner objects to the specification due to informalities. The Examiner indicates on page 2 of the outstanding Office Action (item 2) the location where corrections are required.

Applicants herein amend the specification on pages 3, 4 and 12 as the Examiner suggested. Additionally, Applicants have amended pages 28 and 29 to remove awkwardly worded text.

Applicants respectfully request reconsideration and withdrawal of the present objection.

Claim Objection

On page 2 of the Office Action, the Examiner asserts that claims 8-10 are objected to as being in improper form. Applicants have cancelled claims 9 and 10 thus rendering moot the objection as to these claims.

Applicants respectfully traverse the objection to claim 8.

Applicants submit that claim 8 is a proper dependent claim. Applicants' representative thanks the Examiner for discussing and clarifying this claim objection. During the discussion, the Examiner agreed with Applicants' representative that claim 8 was a proper dependent claim and indicated that the objection would be withdrawn.

Applicants respectfully request reconsideration and withdrawal of the above objection.

Rejection under 35 U.S.C. § 103(a)

Claims 1-10 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Satsuma *et al.*, U.S. Patent Application Publication No. 2003/0215704 (hereinafter "Satsuma") in view of JP 2003-119313 (hereinafter "JP '313"), and further in view of Kobayashi *et al.*, U.S. Patent No. 6,802,925 (hereinafter "Kobayashi"). Claims 4 and 9-10 have been cancelled, thus rendering the rejection moot as to these claims.

Applicants respectfully traverse the rejection as applied to the remaining claims.

The Examiner's Position:

The Examiner asserts that the present application is obvious in light of the above cited references, as indicated on pages 3-8 of the outstanding Office Action.

Based on the following, Applicants contend that the Examiner's position is not supportable, thereby making the presently claimed invention unobvious over the cited references.

Applicants' Position

Differences between the Presently Claimed Invention and the Cited References

The presently claimed invention is directed to an adhesive-carrying porous film for use as a battery separator. The adhesive-carrying porous film comprises a substrate porous film such that when a probe of a probe penetrating thermomechanical analyzer (the probe having a diameter of 1 mm) is placed on the porous film under a load of 70 g to measure a thickness thereof while heating the porous film from room temperature at a rate of 2 °C/minute, a

temperature at which the thickness of the porous film decreases to a half of the thickness of the porous film when the probe was initially placed thereon is 200 °C or more; and a partially crosslinked adhesive carried on the substrate porous film, and having a gel fraction in a range of 5 to 80%. The partially crosslinked adhesive is prepared by carrying on the substrate porous film a reactive polymer having a functional group capable of reacting with a polyfunctional isocyanate and a polyfunctional isocyanate in such a quantity sufficient for the reactive polymer to be partially crosslinked, and then by reacting the reactive polymer with the polyfunctional isocyanate.

As the partially crosslinked adhesive is as defined above, it contains substantially no polyfunctional isocyanate, but still contains a certain amount of functional groups, and such functional groups are capable of further reacting with a polyisocyanate if it is freshly provided.

Furthermore, the partially crosslinked adhesive is more effective as an adhesive than a mere mixture of a reactive polymer and a poly functional isocyanate that is disclosed in the Satsuma reference. Accordingly, an electrode is temporarily bonded more readily to the substrate porous film than an electrode in the Satsuma reference, thereby providing an electrode/porous film laminate with such adhesion strength that if the laminate is immersed in an electrolytic solution, the electrode remains temporarily bonded to the porous film.

Therefore, the use of an adhesive-carrying porous film as in amended claim 1 of the presently claimed invention makes it possible to manufacture a battery with no mutual slip movement between the electrode and the porous film (*i.e.*, a separator; see page 3, lines 11-19 of the present specification).

Additionally, when manufacturing a battery, the electrode/porous film laminate is placed in a battery can, and then an electrolytic solution containing a dissolved polyfunctional isocyanate is poured into the battery can so that the reactive polymer in the partially crosslinked

adhesive of the laminate is further reacted with the polyfunctional isocyanate in the electrolytic solution and is further crosslinked. The electrode is thereby (not temporarily, but) completely bonded to and integrated with the porous film, which provides an electrode/separator adherend. A battery is thus obtained which has the electrode/separator adherend in which the porous film functions as a separator and the electrode is firmly bonded to the separator.

As the porous film is as defined in amended claim 1, the battery obtained according to the presently claimed invention has a separator which does not melt or break, and has very small heat shrinkage under a high temperature environment (see page 3, lines 11-19 of the present specification).

Applicants respectfully disagree with the assertion made by the Examiner that it would have been obvious to substitute the substrate porous film with the substrate porous film of JP '313 and modify the adhesive of Satsuma by incorporating the partially crosslinked adhesive of Kobayashi. Applicants contend that this is not the case and provide the following distinctions for the cited references.

Satsuma

The Satsuma reference discloses an adhesive composition supporting separator for a battery, which comprises a porous substrate supporting thereon a thermally cross-linkable adhesive composition that comprises a polyfunctional isocyanate and a reactive polymer having a functional group capable of reacting with an isocyanate group of the polyfunctional isocyanate.

As the Examiner acknowledges, Satsuma is completely silent concerning the partially crosslinked adhesive carried on the substrate porous film.

Additionally, Applicants submit that the thermally cross-linkable adhesive composition in Satsuma is a mere mixture of a polyfunctional isocyanate and a reactive polymer.

According to Satsuma, an anode and a cathode are respectively placed on the cross-linkable adhesive composition on the porous substrate film and the electrodes are contact-pressed or temporarily bonded to the substrate porous film to provide an electrode/separator laminate (see Satsuma paragraph [0028]).

Satsuma also discloses that when the electrodes are contact-pressed or temporarily bonded to the porous substrate film, the cross-linkable adhesive composition on the porous substrate film is in a substantially non-reacted state, with the adhesive composition not being cross-linked nor cured (see paragraph [0029]). That is, the electrodes are temporarily bonded to the porous substrate film while the cross-linkable adhesive composition on the porous substrate film is in a substantially non-reacted state.

Additionally, the Satsuma reference indicates that the laminate is then heated to react the polyfunctional isocyanate with the reactive polymer so that the reactive polymer is crosslinked, that is, the crosslinkable adhesive composition is crosslinked and cured, thereby the electrodes are completely bonded to the substrate porous film to provide an electrode/separator bonded material or an electrode/separator adherend (see paragraph [0029]).

The electrode/separator adherend is then placed in a battery can, and then an electrolytic solution is poured into the can. The can is then sealed, thus producing a battery (see Satsuma paragraph [0031]).

In contrast, as discussed above for the presently claimed invention, when a battery is assembled, the electrode/porous film laminate is immersed in an electrolytic solution which contains a dissolved polyfunctional isocyanate so that the reactive polymer (which remains unreacted) in the partially crosslinked adhesive of the electrode/porous film laminate is now further reacted with the polyfunctional isocyanate in the electrolytic solution so that the reactive crosslinked adhesive is further crosslinked. The electrode is thereby completely bonded to and

integrated with the porous film to provide a battery having an electrode/separator adherend in which the porous film functions as a separator and the electrode is firmly bonded to the separator.

Thus, the partially crosslinked adhesive has two important roles in the presently claimed invention.

First, the electrode/porous film laminate is composed of a substrate porous film and an electrode temporarily bonded thereto with a partially crosslinked adhesive, and therefore the partially crosslinked adhesive still contains functional groups capable of reacting with a polyfunctional isocyanate. In view of this, the partially crosslinked adhesive can temporarily bond an electrode to the porous film more readily with a stronger adhesion strength than a mere mixture of a reactive polymer and a polyfunctional isocyanate that is disclosed in the Satsuma reference.

Second, when the electrode/porous film laminate comes into contact with an electrolytic solution containing a polyfunctional isocyanate, the partially crosslinked adhesive further reacts with the polyfunctional isocyanate to form a three dimensionally crosslinked polymer, thereby the electrode is completely bonded to the substrate porous film.

In view of the above roles for the partially crosslinked adhesive, the Satsuma reference is completely silent concerning such a partially crosslinked adhesive carried on a substrate porous film.

With the above in mind, the Examiner has asserted that although Kobayashi is said to be relied upon solely for its teaching that it is known to partially crosslink adhesive compositions, Kobayashi discloses a partially crosslinked adhesive. Applicants submit that the Kobayashi reference discloses a laminating film. However, Kobayashi discloses a laminating film that

consists of a base material and an image protection layer for protecting a printed image by lamination.

The Kobayashi laminating film comprises a polymer adhesion layer, which Kobayashi further discloses that the cohesive force of the polymer adhesion layer may be adjusted by partial crosslinking of the polymer. In order to adjust the coercive force of the polymer, reactive groups such as hydroxyl or carboxyl groups are introduced into the polymer. The polymer is then partially crosslinked by a polyisocyanate by utilizing the reactive groups introduced into the polymer (see Kobayashi, column 7, lines 1-39).

Since Kobayashi merely discloses such a laminating film as mentioned above, if a crosslinked adhesion layer is used therein, Applicants submit that one of ordinary skill in the technical field of batteries would not have been be motivated to use such an adhesion layer as disclosed in the Kobayashi reference.

Moreover, Kobayashi does not disclose the partially crosslinked adhesive as defined in amended claim 1. Therefore, if the Satsuma reference is considered in view of the Kobayashi reference, Applicants submit that there is no suggestion regarding the partially crosslinked adhesive carrying porous film for use as a battery separator according to the presently claimed invention. Applicants further submit that there is no suggestion of the unexpected performance which the partially crosslinked adhesive, as defined in amended claim 1, accomplishes in the course of the manufacture of a battery.

Specifically, Kobayashi does not disclose such a partially crosslinked adhesive that has still a certain amount of functional groups, which are to be further reacted with a polyfunctional isocyanate when it is freshly provided. Accordingly, two important roles for the partially crosslinked adhesive, discussed above, are accomplished in the presently claimed invention.

In view of the above, Applicants submit that even if the Satsuma reference is considered with JP '313 and further in view of Kobayashi, the combination of references do not teach or suggest the partially crosslinked adhesive carrying porous film (for use as a battery separator) of amended claim 1.

In light of the above amended claims and remarks, Applicants submit that the assertions made by the Examiner regarding the above references are incorrect, thus making the Examiner's position not supportable. Accordingly, based on the differences between the presently claimed invention and the above references, the cited references do not teach or suggest the presently claimed invention. Therefore, the presently claimed invention is unobvious to one of ordinary skill in the art.

Regarding the secondary references, they fail to remedy the deficiencies of the Satsuma reference. Therefore, even if the references were combined in the manner asserted by the Examiner, the result of such a combination would still not suggest the presently claimed invention.

Since claims 2, 3 and 5-8 ultimately depend from amended claim 1, these claims are unobvious over the cited references for the same reasoning above.

Applicants respectfully request reconsideration and withdrawal of the above rejection.

Conclusion

Applicants respectfully submit that all of the objections and rejections raised by the Examiner have been overcome, and that the present application now stands in condition for allowance.

Should there be any outstanding matters that need to be resolved, the Examiner is respectfully requested to contact Paul D. Pyla at the telephone number below, in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized to charge payment or credit any overpayment to Deposit Account No. 23-0975 for any additional fees required under 37 C.F.R. §§1.16 or 1.17.

Respectfully submitted,

Tomoaki ICHIKAWA et al.

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